MONTHLY WEATHER REVIEW.

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INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during March, 1885, based upon the reports from the regular and voluntary observers of the Signal Service and from co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic ocean during the month are also given, and their approximate paths shown on chart i.

The most noteworthy meteorological features of the month were the marked departures from the normal temperature and precipitation.

The month was exceptionally cold in the districts east of the Mississippi river, and also in the west Gulf states and southern slope. Except in Florida and Tennessee, the mean temperatures in the districts east of the Mississippi averaged more than 6° below the normal; the departures were greatest in the lake region where they exceeded 9°. In the upper Missouri valley, Rocky mountain regions, and on the Pacific coast the month was warmer than the average; in these districts the temperature averaged from 2° to 6° above the normal.

The precipitation was deficient over nearly the whole country, the departures from the average being unusually large in the districts east of the Mississippi and on the Pacific coast.

On chart i. are traced the paths of the centres of eleven atmospheric depressions which are described under "Areas of low barometer;" the average number of depressions charted for March during the last eleven years is 12.5.

But few local storms occurred during the month, and those reported were not unusually severe.

During the night of the 15–16th an auroral display was observed in nearly all the northern districts and as far southward as Nashville, Tennessee.

In the preparation of this REVIEW the following data, received up to April 20th, 1885, have been used, viz.: the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and twenty-nine Signal Service stations and nineteen Canadian stations, as telegraphed to this office; one hundred and sixty-nine monthly journals and one hundred and sixty-nine monthly means from the former, and nineteen monthly means from the latter; two hundred and ninety-eight monthly registers from voluntary observers; forty-six monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs, furnished by the publishers of "The New York Maritime Register;" monthly reports from the New England Meteorological Society, and from the local weather services of Alabama, Georgia, Illinois, Indiana, Louisiana, Minnesota, Missouri, Nebraska, Ohio, and Tennessee, and of the Central Pacific Railway Company; trustworthy newspaper extracts; and special reports.

ATMOSPHERIC PRESSURE.

[*Expressed in inches and hundredths.*]

The distribution of mean atmospheric pressure for March, 1885, determined from the tri-daily telegraphic observations of the Signal Service, is shown by the isobarometric lines on chart ii.

An area of barometric maxima occupies the northern and central Rocky mountain districts where the mean pressures range from 30.2 to 30.28; an area of barometric minima is shown over New England and the Maritime Provinces, where the barometric means vary from 29.9 to 29.96. The mean pressure is above 30.1 over nearly the entire country, the isobar for 30.1 being traced from western Lake Superior to the south Atlantic states and thence along the southern borders of the country to the Pacific coast.

Compared with the mean pressure for the preceding month there has been an increase (instead of the usual decrease which occurs in March) in all parts of the United States, except on the middle Pacific coast, where the barometric means are from .04 to .06 below those for February. The increase is most marked over the Rocky mountain districts and the north Pacific coast, where it varies from .10 to .18. In all districts east of the Rocky mountains the mean pressures are from .04 to .10 higher than those for February.

Compared with the normal pressure for March an increase is shown over nearly the whole country. At Alpena, Michigan, a slight deficiency occurs, but at all other stations the mean pressure is above the normal. Over an extensive area, reaching from the west Gulf states to the north Pacific coast, the departures exceed .10. The greatest departures are as follows: Olympia, Washington Territory, and Santa Fé, New Mexico, .15; Fort Apache, Arizona, .16.

BAROMETRIC RANGES.

The monthly barometric ranges for the several stations are given in the table of miscellaneous meteorological data; they were greatest in the northern districts to the east of Dakota, and least at the Rocky mountain stations, in Florida, Rio Grande valley, and California. The smallest ranges are .33 at Fort Apache, Arizona, and .38 at Fort Maginnis and Helena, Montana; the largest are 1.29 at Saint Vincent, Minnesota; 1.30 on the summit of Mount Washington, New Hampshire; and 1.33 at Eastport, Maine.

AREAS OF HIGH BAROMETER.

During the month seven areas of high barometer passed over the districts east of the Rocky mountains. The pressure in nearly all districts during the first week of the month remained somewhat high, and it was not until the 7th that any well-defined area made its appearance.

I.—This area first appeared in Idaho during the afternoon of the 7th, moving slowly southeastward. The area, though well-defined and of considerable magnitude, had but little influence on the temperature, which, at the time the area was first observed, was in nearly all districts abnormally low. The fall in temperature accompanying the movement of the area

was from 10° to 20°. At midnight of the 8th the centre of greatest pressure was in the Gulf states, and by the afternoon of the 9th the area had passed into the Gulf of Mexico, the direction of movement being directly southeastward.

II.—After the passage of low area ii. the barometer rose rapidly at stations in Manitoba, the change in eight hours being from .30 to .40. The afternoon report of the 9th showed that the area of high pressure covered the western portion of the upper lake region, the extreme northwest and the northern portions of the upper Mississippi and Missouri valleys. In the extreme northwest the temperature in twenty-four hours, fell from 20° to 30°. Continuing its southeasterly movement on the morning of the 10th, the area covered the lake region, the Ohio, upper Mississippi and Missouri valleys, and the barometer began to rise rapidly in the middle Atlantic states. At this report the centre of greatest pressure was in Manitoba and the temperature at Prince Arthur's Landing on Lake Superior, stood —13°, being a fall of 44° in twenty-four hours. The fall at neighboring stations in the upper lake region was about 30°. On the morning of the 11th, the centre of the area was in the middle Atlantic states, where the temperature had fallen 10° to 20°; the greatest change in the temperature was in the Saint Lawrence valley, averaging from 20° to 30°. During the afternoon of the 11th, the area passed into the Atlantic. Its movement, in connection with low area ii. caused the high westerly winds which prevailed on the Atlantic coast from the 9th to 11th.

III.—The midnight report of the 11th showed the presence of this area in the extreme northwest. Its movement was almost identical with that of number ii., viz: to the eastward. It was central at midnight of the 12th in the Saint Lawrence valley, where the temperature fell about 20° in twenty-four hours. At the same hour it made its appearance, low area iii. developed in the Indian Territory. The movement of this high area over the northern districts prevented the depression taking the northeasterly course usual with storms which originate in that section of the country. Passing over New England and the middle Atlantic states, causing a fall in temperature of about 20°, the area disappeared on the 13th. High northeasterly winds prevailed on the Atlantic coast during the passage of this high area in connection with the movement of low area iii.

The minimum temperature for the month at several stations in the lower lake region and New England occurred on the 13th. At Oswego, New York, a temperature of —9.6 occurred, which is the lowest recorded in March since 1872, when a temperature of —11° occurred.

IV.—The afternoon report of the 15th showed the barometer to be rising in the extreme northwest, with a decided fall in temperature in that district. On the morning of the 16th the centre of greatest pressure was in Manitoba. In the lake region and upper Mississippi valley the temperature had fallen in twenty-four hours between 20° and 25°, and in the Missouri valley about 30°. This area followed immediately after low areas iv. and v. At 7 a. m. of the 17th the centre was in the Missouri valley, the area having moved in an almost direct southerly course. After this report the pressure diminished considerably, and the area was last observed in northern Texas at midnight of this date. The greatest change in temperature occurred during the movement of this high area in the western and southern districts, amounting to about 20°, but its influence was felt in all districts as far east as the New England states, causing a reduction in temperature of from 10° to 15°. In the extreme northwest, upper Mississippi and Missouri valleys, and middle slope the minimum temperatures for the month occurred on the 16th and 17th, during the prevalence of this high area.

V.—This area was first observed on the afternoon of the 18th in Montana. On the morning of the 19th it was central in Manitoba, accompanied by a fall in temperature of 20°. It moved southeastwardly until it reached the middle Atlantic states, where it remained for a short while stationary, and on the 20th united with, and formed a part of high area number vi. The cold wave accompanying this area affected all districts except the Gulf states, the reduction in temperature being about 15°.

VI.—During the afternoon of the 20th and following immediately after the development and subsequent movement of low area vi. the barometer at stations in the extreme northwest rose rapidly, and by midnight of that date there appeared a well-defined area of high pressure with its centre north of Manitoba. The temperature in the Missouri valley, though low for the month, continued to fall, and was, on the morning of the 21st, about 10° lower than at the morning report of the 20th. During the 21st the area gradually extended and covered all districts except the south Atlantic states, where the depression was then central. The cold wave accompanying the rapidly rising barometer in rear of the low area caused the temperature to fall about 20°, the greatest change being in the Gulf and south Atlantic states. On the morning of the 22d the centre of greatest pressure was in Manitoba, and on the 23d in the Mississippi valley; from thence it moved southeastwardly and disappeared off the coast of the south Atlantic states on the 24th. In the west Gulf states and nearly everywhere east of the Mississippi river the minimum temperatures of the month occurred from the 20th to 24th, during the prevalence of this high area. At Escanaba, Michigan, a temperature of —24°.6 occurred on the morning of the 21st, this being the lowest recorded at so late a date since the station was established in 1872; in only one instance during that time has a lower temperature been recorded in March, viz, in 1884, on the 1st of the month.

VII.—This area first appeared in the extreme northwest on the afternoon of the 30th. The morning report of the 31st showed that the temperature in Manitoba had fallen 30° in twenty-four hours. At midnight the centre of the area was north of Manitoba. The barometer at stations in the lake region began rapidly to rise and indicated that the area was moving in that direction. A further description of this area will be found in the REVIEW for April.

AREAS OF LOW BAROMETER.

On chart i. are traced the paths of the centres of areas of low barometer which passed over the country during the month. But nine areas have been considered of sufficient importance for charting and description. Numbers i., ii., iv. and vii. made their appearance near Manitoba, and number v. approached the middle Atlantic coast from the sea. Numbers i., iv. and ix. disappeared in the Province of Ontario. Number vi., having a very peculiar track, has been traced for four days. These nine areas are described below.

The following table shows the latitude and longitude in which the centre of each area was first and last located, and the average hourly movement.

Areas of low barometer.	First observed.		Last observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long W.	
	° ′	° ′	° ′	° ′	
No. I	52 30	102 00	46 00	79 30	26.5
II	52 30	104 30	46 30	58 00	41.5
III	37 30	98 00	34 00	77 00	39.0
IV	51 30	103 30	46 30	79 00	33.0
V	39 00	73 30	48 00	66 00	33.5
VI	48 30	102 30	47 00	57 00	40.5
VII	51 00	100 00	51 00	63 30	34.0
VIII	37 00	83 30	35 00	74 00	34.5
IX	49 00	105 00	40 00	80 00	35.0
Mean hourly velocity					36.0

I. This area made its appearance in the Saskatchewan valley on the morning of the 2d, moving in a southeasterly direction. During the day light snows began falling in the lake region. The morning report of the 3d showed the centre of depression to be in western Michigan. From this point the area altered its course to a northeasterly direction and passed beyond the

limits of observation on the 4th. It was not accompanied by any high winds and with little precipitation.

II. This area appeared also in the Saskatchewan valley on the afternoon of the 8th, and moved in an almost direct southeasterly course to the coast of Maine, where it was central on the morning of the 10th. After this report it moved northeastwardly, passing over Nova Scotia and disappeared during the night of the 10th. Its passage was marked by violent gales on the lakes and the Atlantic coast and light precipitation in the northern districts. The lowest observed barometer was 29.32 at Halifax on the 10th. The following wind velocities occurred on the 9th: Alpena, Michigan, 40, w., at 9.50 p. m.; Toledo, Ohio, 40, sw., at 3.40 p. m.; Sandusky, Ohio, 43, sw., at 3.20 p. m.; Buffalo, New York, 56, sw., at 8.05 p. m.; Rochester, New York, 48, w., at 6.45 p. m. At Boston, Massachusetts, a velocity of 39, w., occurred at 9.45 a. m. on the 10th. The observer at Portland, Maine, reports that the signal displayed in advance of this storm was not justified at that station, but rough weather was experienced by vessels outside of the harbor on the 10th.

III.—Rain began falling in the western Gulf states during the afternoon of the 11th, and at midnight there developed in the Indian Territory an atmospheric depression which increased considerably in energy on the 12th. It moved in a direction a little south of east to the Atlantic coast, and was central off North Carolina on the morning of the 13th, and during the day disappeared. Quite heavy rains in the southern states, with light rains and snow in the middle Atlantic states and the Ohio valley and Tennessee, marked its passage.

IV.—The midnight report of the 13th showed the presence of this depression to the west of Manitoba. At this report the barometer at stations in the extreme northwest was over .50 below the normal. On the morning of the 14th the storm-centre was near Duluth, and rain and snow began falling in the lake region. After this report the depression recurved, the centre passing over the northern portions of Lakes Michigan and Huron. At 7 a. m. of the 15th the centre was near Rockcliffe, Province of Ontario, and was last observed at midnight of the 15th moving in a northeasterly direction. The lowest observed barometer was 29.24 at Rockcliffe on the 15th. At Milwaukee, Wisconsin, a wind velocity of 45, nw., occurred at 10.15 p. m. on the 14th, and on the 15th the following velocities were reported: Grand Haven, Michigan, 49, nw.; Escanaba, Michigan, 39, n.; Toledo, Ohio, 36, sw., at 4.07 a. m.; Sandusky, Ohio, 47, nw., at 5 a. m.; Erie, Pennsylvania, 35, w., at 8.30 a. m.; Buffalo, New York, 56, sw., at 9.20 a. m.; Rochester, New York, 52, sw., at 10.15 a. m.; Oswego, New York, 38, sw., at 11.15 a. m.

V.—This storm approached the middle Atlantic coast from the sea on the afternoon of the 15th about the same time that number iv. was passing over the Canadian provinces. At this hour, as closely as can be estimated the centre was nearly fifty miles to the east of Cape Henlopen. High winds prevailed on the Atlantic coast with general rains in New England, the middle, and south Atlantic states. On the morning of the 16th the centre was in eastern Maine, the depression having moved northeastwardly. Still continuing its initial movement it passed beyond the limits of observation on the 16th. Severe gales were reported from all stations on the New England and New Jersey coasts. The observer at Eastport reports that the storm began at 11.45 p. m. and continued until 8 a. m. of the 16th, the maximum wind-velocity, 43 miles, se., occurring at 6.40 a. m. The schooner "Dawn" was wrecked on Swallow-tail Rocks during the night of the 15–16th.

VI.—This storm having a peculiar track, developed in northern Dakota at midnight of the 19th. It moved directly south to Texas, where it was central on the morning of the 21st. It then recurved, passing over the Gulf of Mexico and northern Florida and moved in a northeasterly direction along the Atlantic coast. The morning report of the 22d showed the centre to be off Savannah, Georgia, and on the 23d off Nova Scotia, from whence it passed beyond the stations of observation. It was accompanied by precipitation in all districts except the lake region and by very high winds on the Gulf and Atlantic coasts. The lowest observed barometer was 29.74, at Sydney, Nova Scotia, on the 23d.

The observer at Norfolk, Virginia, reports the following: "a snow storm accompanied by high northerly winds began during the early morning of the the 22d and continued for twenty-four hours. Snow fell to a depth of four inches and six tenths, which, for this season of the year, is without precedent since the establishment of the signal office. The schooner "A. M. Bailey" was driven ashore during the storm near Cape Henry and became a total loss."

VII.—This area made its appearance in Manitoba on the morning of the 23d. It was central at 7 a. m. of the 24th, over Lake Huron. Light snows began falling in the lake region with strong south to west winds. The morning report of the 25th, showed the centre to be near Father Point, and the area passed into the Gulf of Saint Lawrence during the day. It moved at first in a southeast direction, but after reaching Lake Huron it recurved and passed down the Saint Lawrence valley. Its influence was but slightly felt on the Atlantic coast.

VIII.—On the morning of the 28th heavy rains began falling in the Gulf states and the reports showed the presence of a trough of barometric depression extending from Texas to eastern Tennessee. During the afternoon an area of low barometer formed from this trough in eastern Tennessee. The depression was at first weak but increased greatly in energy as it approached the North Carolina coast where it was central on the morning of the 29th. The winds in the immediate vicinity of the storm-centre reached a velocity of from forty-five to sixty miles an hour and on the New Jersey and southern New England coasts they had a velocity of from thirty to forty miles. Snow fell in New England and rains in the middle, south Atlantic, and Gulf states.

IX.—This depression was first observed on the morning of the 29th in northern Montana. It moved in a southeasterly direction to Lake Michigan, where it was central on the morning of the 30th. From thence it took a northeasterly course and passed beyond the limits of observation during the day. Light rains and snow fell during its passage in the lake region, upper Mississippi and Missouri valleys. The storm had but little energy, and the winds on the lakes, though strong, were not dangerous.

A very violent storm visited the Nova Scotia coast on the 19th, and is described in chapter on North Atlantic Storms. This storm was very severe and affected the whole Atlantic coast as far south as Smithville, North Carolina. During its passage the wind at Mount Washington, New Hampshire, on the 21st, reached a velocity of 128 miles per hour, and the temperature fell to —47°.

NORTH ATLANTIC STORMS DURING MARCH, 1885.

[*Pressure expressed in inches and in millimetres; wind-force by scale of* 0-10.]

The paths of the depressions that have appeared over the north Atlantic ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports furnished through the co-operation of the "New York Herald Weather Service," and from other miscellaneous data received at this office up to April 22d, 1885.

Of the ten depressions traced during the month, three, viz.: numbers 6, 7 and 10 were continuations of storms which entered the Atlantic from the North American continent; number 2 was a continuation of a depression which occupied mid-ocean at the close of February; numbers 1 and 4 prevailed over the region to the eastward of the thirtieth meridian, while the remaining depressions, numbers 3, 5, 8, and 9, first appeared near the American coast. The general direction of movement of the storm-centres was northeasterly; the tracks of numbers 7 and 8, however, were somewhat abnormal, those